
CURRICULUM/REGULATIONS

FOR

4 YEARS DEGREE PROGRAMME

IN

RADIOLOGY

(MD RADIOLOGY)



FATIMA JINNAH
MEDICAL UNIVERSITY, LAHORE
Government of The Punjab

FATIMA JINNAH MEDICAL UNIVERSITY, LAHORE

Nomenclature Of The Proposed Course

The name of degree programme shall be MD Radiology. This name is well recognized and established for the last many decades worldwide.

Course Title:

MD Radiology

Training Centers

Departments of Radiology (accredited by FJMU) in affiliated institutes of Fatima Jinnah Medical University Lahore.

Duration of Course

On

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• The duration of MD Radiology course shall be four (4) years with structured training in a recognized department under the guidance of an approved supervisor.

After admission in MD Radiology Programme the resident will spend first 6 Months in the relevant Department of Radiology as **Induction period** during which resident will get orientation about the chosen discipline and will also participate in the **mandatory workshops** (Appendix E). The research project will be designed and the **synopsis** be prepared during this period.

On completion of Induction period the resident will start formal training in the Basic Principles of Internal Medicine & General Surgery for 03 Months each. At the end of one calendar year, the candidate will take up Abridged Examination. During the 2nd, 3rd & 4th years, of the Program, there will be two components of the training

- 1) Training in Radiology
- 2) Research and Thesis writing

The candidate will undergo clinical training to achieve the educational objectives of M.D. Radiology Programme (knowledge & Skills) alongwith two rotational placements in 2nd year and two rotations in the 3rd year of the programme each for 2 months duration as follows :-

1. Isotope Imaging
2. MRI
3. Interventional Radiology



4. Neuro Radiology

The clinical training shall be competency based. There shall be generic and specialty specific competencies and shall be assessed by continuous Internal Assessment. (Appendix F&G).

The Research Component and thesis writing shall be completed over the four years duration of the Programme. Candidates will spend total time equivalent to one calendar year for research during the training. Research can be done as one block or in small periodic rotation as long as total research time is equivalent to one calendar year.

Admission Criteria

Applications for admission to MD Training Programs of University will be invited through advertisement in print and electronic media mentioning closing date of applications and date of Entry Examination.

Eligibility: The applicant on the last date of submission of applications for admission must possess the:

- i) Basic Medical Qualification of MBBS or equivalent medical qualification recognized by Pakistan Medical & Dental Council.
- ii) Certificate of one year's House Job experience in institutions recognized by Pakistan Medical & Dental Council Is essential at the time of interview. The applicant is required to submit House Certificate from the concerned Medical Superintendent that the House Job shall be completed before the Interview.
- iii) Valid certificate of permanent or provisional registration with Pakistan Medical & Dental Council.

Registration and Enrollment

- As per policy of Pakistan Medical & Dental Council the number of PG Trainees/ Students per supervisor shall be maximum 05 per annum for all PG programmes including minor programmes (if any).
- Beds to trainee ratio at the approved teaching site shall be at least 5 beds per trainee.
- The University will approve supervisors for MD courses.
- Candidates selected for the courses after their enrollment at the relevant institutions shall be registered with FJMU as per pre scribed Registration Regulations.

Accreditation Related Issues of the Institution

1. Faculty

Properly qualified teaching staff in accordance with the requirements of Pakistan Medical and Dental Council (PMDC)

2. Adequate Space

Including class-rooms (with audiovisual aids), demonstration rooms, computer lab and clinical pathology lab etc.

3. Library

Departmental library should have latest editions of recommended books, reference books and latest journals (National and International).



- Accreditation of Radiology training program can be suspended on temporary or permanent basis by the University, if the program does not comply with requirements for residents training as laid out in this curriculum.
 - Program should be presented to the University along with a plan for implementation of curriculum for training of residents.
 - Programs should have documentation of residents training activities and evaluation on monthly basis.
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- To ensure a uniform and standardized quality of training and availability of the training facilities, the University reserves the right to make surprise visits of the training program for monitoring purposes and may take appropriate action if deemed necessary.



AIMS AND OBJECTIVES OF THE COURSE

AIM

The aim of four years MD programme in Radiology is to train residents to acquire the competency of a specialist in the field of Radiology so that they can become good teachers, researchers and clinicians in their specialty after completion of their training.

GENERAL OBJECTIVES

MD Radiology training should enable a student to:



- Access and apply relevant knowledge to clinical practice:
 - Maintain currency of knowledge
 - Apply scientific knowledge in practice
 - Appropriate to patient need and context
 - Critically evaluate new technology
- Safely and effectively performs appropriate clinical skills & procedures:
 - Consistently demonstrate sound clinical skills
 - Demonstrate procedural knowledge and technical skill at a level appropriate to the level of training
 - Demonstrate manual dexterity required to carry out procedures
 - Adapt their skills in the context of each patient and procedure
 - Maintain and acquire new skills
 - Approach and carries out procedures with due attention to safety of patient, self and others
 - Critically analyze their own clinical performance for continuous improvement
- Design and implement effective management plans:
 - Recognize the clinical features, accurately diagnose and interpret the radiological findings
 - Formulate a differential diagnosis based on investigative findings
 - Manage patients in ways that demonstrate sensitivity to their physical, social, cultural and psychological needs
 - Recognize disorders of the organ systems and differentiate those amenable to medical or surgical treatment



- Effectively recognize and manage complications
- Accurately identify the benefits, risks and mechanisms of action of current and evolving treatment modalities
- Indicate alternatives in the process of interpreting investigations and in decision-making
- Manage complexity and uncertainty
- Consider all issues relevant to the patient
- Identify risk
- Assess and implement a risk management plan
- Critically evaluate and integrate new technologies and techniques.
- Organize diagnostic testing, imaging and consultation as needed:
 - Appraise and interpret appropriate diagnostic imaging and investigations according to patients' needs
 - Critically evaluates the advantages and disadvantages of different investigative modalities
- Communicate effectively:
 - Communicate appropriate information to patients (and their family) about procedures, potentialities and risks associated with the procedure in ways that encourage their participation in informed decision making
 - Communicate with the patient (and their family) the treatment options including benefits and risks of each
 - Communicate with and co-ordinate health management teams to achieve an optimal radiological environment
 - Initiate the resolution of misunderstandings or disputes



- Modify communication to accommodate cultural and linguistic sensitivities of the patient
- Recognize the value of knowledge and research and its application to clinical practice:
 - Assume responsibility for self-directed learning
 - Critically appraise new trends in Radiology
 - Facilitate the learning of others
- Appreciate ethical issues associated with Radiology:
 - Consistently apply ethical principles
 - Identify ethical expectations that impact on medico-legal issues
 - Recognize the current legal aspects of informed consent and confidentiality
 - Be accountable for the management of their patients.
- Professionalism by:
 - Employing a critically reflective approach to Radiology
 - Adhering with current regulations concerning workplace harassment
 - Regularly carrying out self and peer reviewed audit
 - Acknowledging and have insight into their own limitations
 - Acknowledging and learning from mistakes
- Work in collaboration with members of an interdisciplinary team where appropriate:
 - Collaborate with other professionals in the selection and use of various types of treatments assessing and weighing the indications and contraindications associated with each type



- Develop a care plan for a patient in collaboration with members of an interdisciplinary team
- Employ a consultative approach with colleagues and other professionals
- Recognize the need to refer patients to other professionals.
- Management and Leadership
 - Effective use of resources to balance patient care and system resources
 - Identify and differentiate between system resources and patient needs
 - Prioritize needs and demands dealing with limited system resources.
 - Manage and lead clinical teams
 - Recognize the importance of different types of expertise which contribute to the effective functioning of clinical team
 - Maintain clinically relevant and accurate contemporaneous records
- Health advocacy:
 - Promote health maintenance of patients
 - Advocate for appropriate health resource allocation

SPECIFIC LEARNING OUTCOMES

Residents completing MD Radiology training will have formal instruction, clinical experience, and will be able to demonstrate competence as follows:-

- Describe aetiology, pathophysiology, and principles of diagnosis and management of common problems including emergencies, in adults and children
- Demonstrate understanding of basic sciences relevant to this specialty.
- Take a proper clinical history, examine the patient, perform essential diagnostic/interventional procedures and interpret the results to come to a reasonable diagnosis or differential diagnosis in the condition
- Provide basic life saving support service in emergency situations



- Demonstrate appropriate proficiency in Body Imaging with the proper clinical and radiologic indications including scientific principles in:
 - Basic radiation biology and radiation protection
 - Basic radiopharmacy and radiochemistry
 - Principles of tracer technology
 - Diagnostic imaging: mode of pharmaceutical uptake; normal and abnormal appearances of images, normal variants and common artifacts in bone, heart, lung, kidney, brain, thyroid, tumor and infection images.
 - Therapeutic applications: basic principles of radionuclide therapy; treatment of hyperthyroidism, thyroid cancer and metastatic bone pain.
 - Principles of radiation protection: ALARA (as low as reasonably achievable), ALARP (as low as reasonably practicable).
 - Diagnosis and treatment of thyroid diseases.
 - Tracer kinetics
 - Computing and image processing
 - Radiobiology including the biological effects of high and low levels of radiation
 - Linear hypothesis and the threshold hypothesis of the biological response to low level radiation
 - The effective dose equivalent and the calculation of radiation dose from radiopharmaceuticals.
 - Radiopharmacy:
 - Properties of commonly used diagnostic and therapeutic radiopharmaceuticals
 - Production of radionuclides by reactors, cyclotrons and radionuclide generators
 - Quality assurance and quality control of radiopharmaceuticals.
 - Principles of radiology including dual energy X ray absorption (DEXA), ultrasound, CT and MRI imaging
 - Learning of cross-sectional anatomy
 - Correlative imaging of NM images and those from other imaging techniques
 - Special diagnostic investigations in cardiology, lung disease, gastroenterology, hepatobiliary diseases, nephro-urology, neurology and psychiatry, endocrinology, hematology, oncology and infection



- Therapeutic applications
- Treatment of bone metastases, neuroendocrine tumours and other malignancies as well as polycythemia
- Use of radio-labeled monoclonal antibodies and peptides for tumor therapy
- State the physiologic properties, proper concentrations and proper indications for the use of the following contrast material:
 - Barium
 - Water soluble contrast media (oral Hypaque or Gastrografin)
 - Ionic intravenous contrast media
 - Non-ionic intravenous contrast media
- Discuss the following information about Glucagon:
 - Proper indications and dosages used in GI radiology
 - Physiologic effects
 - Side effects
 - Contraindications
- List the high risk factors for allergic reaction to intravenous contrast media and their treatment
- Given an appropriate radiograph, demonstrate a basic knowledge of radiographic abnormalities
- Demonstrate basic knowledge of the equipment to be used during fluoroscopy, including proper kilovoltage (KV) techniques for the various procedures, radiation safety features of the machines, and proper radiation safety techniques.
- Demonstrate knowledge of proper KV techniques, patient positioning, and type of after-films that should be taken for the procedures
- Given a fluoroscopic examination, demonstrate the ability to identify the abnormality at fluoroscopy and modify the technique or change the patient's position to take more diagnostic fluoroscopic spot films
- Evaluate and integrate data from other studies (CT, MRI, sonography and nuclear medicine) to make recommendations to the referring physician about more appropriate or additional diagnostic studies needed for evaluation of the patient's abnormality
- State the indications the technical skills and interpret a defecography study
- Discuss thoroughly the ultrasound procedures and findings in:
 - Gallbladder/biliary tree ultrasound (cholelithiasis/cholecystitis)
 - Renal ultrasound (obstruction/renal failure)
 - Pelvic ultrasound (ectopic pregnancy)
 - Cranial ultrasound (intracranial hemorrhage)
 - Duplex Doppler (venous thrombosis of extremities)

- Discuss the basic ultrasound physics and instrumentation, especially related to equipment operation and the specifications for various probes
- Discuss all aspects of ultrasound and radiographic imaging, including indications, pathology, and correlative studies used for each examination:
 - Liver/biliary tree (biliary obstruction/tumors)
 - Pancreas (acute and chronic inflammatory process/tumors)
 - Renal (transplant rejection/Doppler, tumors and inflammatory processes)
 - Pelvis (uterine leiomyoma/ovarian neoplastic and non-neoplastic Diseases)
 - Cranial ultrasound (hydrocephalus/cerebral ischemia and infarction)
 - Duplex Doppler (duplex sonography of carotids and abdominal duplex)
 - Barium swallow /enema
 - Upper GI series
 - Small bowel follow through (SBFT)
 - Enteroclysis
 - Endoscopic retrograde cholangiopancreatography (ERCP)
 - Fistulograms
 - Intravenous Urogram (IVU)
 - Cystogram
 - Voiding cystourethrogram
 - Hysterosalpingraphy (HSG)
- Demonstrate a proficient knowledge of the anatomy, the basic principles and imaging protocols, interpretation and differential diagnosis in the following organ system disorders:

Chest Radiology

- Asthma
- Haemoptysis
- Aneurysms and vascular dissection
- Pulmonary emboli
- Pulmonary neoplasms
- Cardiac enlargement
- Cardiac failure and pulmonary oedema
- Pleural effusion
- Pulmonary collapse and consolidation
- Misplaced endoluminal tubes

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- Pneumothorax, including tension
- Pneumomediastinum and subcutaneous emphysema
- Hyperinflation of lungs
- Free gas beneath the diaphragm
- Detection of pulmonary and mediastinal masses
- Signs of acute vascular problems, including aortic dissection and trauma

Musculoskeletal Radiology

- Common fractures in the limbs
- Fracture of femoral neck
- Fractures of the wrist and scaphoid
- Fractures of the shoulder, including dislocation
- Pelvic fractures
- Signs of osteoarthritis/rheumatoid arthritis
- Sclerotic and lytic metastases
- Skull fracture
- Cervical spine fracture and dislocation
- Fractures in children
- Bone and soft tissue infection
- Bone and soft tissue trauma
- Bone and soft tissue tumours
- Diagnosis of undisplaced or stress fractures
- Investigation of spinal injury
- Investigation of low back pain
- Metabolic bone disease
- Arthritides
- Investigation of haematological disease including anaemia and leukaemia
- Basic knowledge of potential complications of oncological treatment and means of detection

Gastrointestinal Radiology

- Abdominal pain
- Abdominal masses
- Abdominal trauma
- Inflammatory bowel disease
- Jaundice
- Hepatic neoplasms
- Biliary disease

- Small and large bowel obstruction
- Toxic megacolon
- Signs of intestinal perforation
- Aortic aneurysm
- Urinary calculi
- Gallstones
- Endoluminal foreign bodies

Genitourinary Radiology

- Renal failure and urinary obstruction
- Haematuria
- Urological neoplasms
- Renal and urinary infection
- Investigation of suspected pregnancy, including ectopic gestation.
- Post menopausal bleeding
- Gynaecological neoplasms

Neuro and Head & neck-Radiology

- Head injury
- Intracranial haemorrhage and infarction
- Spinal cord compression and radiculopathy
- Intracranial space occupying lesions
- Disease of the ear nose and throat
- Deafness
- Disease of paranasal sinuses
- Cervicofacial cancer
- Salivary disease
- Oropharyngeal lesions

Paediatric Radiology:

- Disease in childhood
- The principles of imaging in children, including protection of the patient and confidentiality.
- Disease of the chest and gastrointestinal tract in childhood, and certain paediatric neoplasms.

Breast Imaging

- Endocrine and breast disease



- Oncological and inflammatory disease
- Principles of oncological staging by imaging and knowledge of common staging classifications

Vascular and Interventional Radiology

- Ultrasound (including Doppler)
- Intravenous and intra-arterial angiography
- CT angiography
- Aortography
- Venography
- Arterial and venous catheterization
- Principles and precautions of interventional radiology

Emergency Radiology:

- Evaluation of the emergency radiographic examinations
- Medicolegal cases (MLC) procedures
- Indications for and limitations of the common emergency imaging procedures
- Findings, diagnosis and other relevant information to the emergency room physician
- Special imaging procedures needed in emergency room e.g.; barium studies, excretory urography, CT, ultrasound, Doppler and angiography

Radiological Skills and Procedures

- Plain film
- Barium Enema
- Barium Meal
- Small Bowel Barium Enema
- Sialogram
- T-Tube cholangiogram
- Knee Arthrogram
- Sinogram/Fistulogram
- Leg Venogram
- Angiographic Examination
- Hysterosalpingogram
- Lymphangiogram



- Abdominal Ultrasound
- Obstetrics and Gynecology
- Neonatal Brain
- Angiography
- Myelogram
- CT Brain & Spine Reporting
- CT Neck and Base of Skull Reporting

- CT Abdomen & Pelvis Reporting
- CT Chest Reporting
- MRI Reporting
- Excretion Urography
- Retrograde Pyelography
- Micturating Cystourethrogram
- Small parts ultrasound
- Portable Ultrasonography
- Mammography
- Radionuclide scanning

Research:

All residents in the categorical program are required to complete an academic outcomes-based research project during their training. This project can consist of original bench top laboratory research, clinical research or a combination of both. The research work shall be compiled in the form of a thesis which is to be submitted for evaluation by each resident before end of the training. The designated Faculty will organize and mentor the residents through the process, as well as journal clubs to teach critical appraisal of the literature.



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REGULATIONS

Scheme of the Course

A summary of four years course in MD Radiology is presented as under:

Course Structure	Components	Examination
<p>At the End of 1st year of Programme</p>	<ul style="list-style-type: none"> • Principles of Internal Medicine • Principles of General Surgery • Physics applied to Radiology 	<p><u>Abridged Examination</u> at the end of 1st Year of M.D. Radiology Programme</p> <p>Written</p> <p>Paper MCQs Video Projected Clinical Examination</p>
<p>At the end of Final year of the Programme</p>	<p style="text-align: center;"><u>Clinical component</u></p> <ul style="list-style-type: none"> • Professional Education in Radiology: <p>Training in Radiology during 2nd, 3rd & 4th years of M.D. Programme</p> <p>Rotation in related fields</p> <p><u>Research component of Final Examination</u></p> <p>Research work / Thesis writing must be completed and thesis be submitted before the end of final year of the programme.</p>	<p><u>Final Examination</u> in specialized components of Radiology at the end of final year (4th) of M.D. Programme.</p> <p>Written:</p> <p>Paper I & II Problem based MCQs and SEQs in the subjects Clinical, TOACS/OSCE & ORAL Continues Internal Assessment.</p> <p>Thesis Evaluation & Defence at this End of 4th year M.D. Radiology.</p>



Abridged Examination

All candidates admitted in M.D. Radiology course shall appear in Abridged Examination at the end of 1st calendar.

Eligibility Criteria:

The candidates appearing in Abridged Examination are required

- a) To have submitted certificate of completion of mandatory workshops.
- b) To have submitted certificate / certificates of completion of first year of training from the supervisor / supervisors of rotations.
- c) To have submitted CIS assessment proforma from his/her own supervisor on 03 monthly basis and also from his/her supervisors during rotation, achieving a cumulative score of 75%.
- d) To have submitted certificate of submission of synopsis.
- e) To have submitted evidence of payment of examination fee.

Abridged Examination Schedule and Fee

- a) Abridged Examination at completion of one year training, will be held twice a year.
- b) There will be a minimum period of 30 days between submission of application for the examination and the conduction of examination.
- c) Examination fee will be determined periodically by the University.
- d) The examination fee once deposited cannot be refunded / carried over to the next examination under any circumstances.



- e) The Controller of Examinations will issue Roll Number Slips on receipt of prescribed application form, documents satisfying eligibility criteria and evidence of payment of examination fee.

All candidates admitted in MD Radiology course shall appear in Abridged Examination at the end of 1st calendar year.

Abridged Examination at the end of 1st calendar

Written Examination = 300 Marks

Video projected clinical Examination = 50 Marks

Total = 350 marks

There shall be 150 MCQs write single best type of answer as for

Basic Principles of Internal Medicine = 50 MCQs

Basic Principles of General surgery = 50 MCQs

Physics applied to Radiology = 50 MCQs

Each MCQ will carry 2 marks and each incorrect response will result in deductions of 1.5 duration of this exam will be 150 minutes. The candidate securing 50% marks will paper the written examination and will be eligible to appear in the video projected clinical exam.

Video Projected Clinical Part of Abridged Exam (VPCE)

The VPCE will consist of 25 videos/ Slides of clinical material and scenarios from Internal Medicine, General Surgery and Radiology. Each Video/ slide will have one question and carry 2 marks. Incorrect response will result in deduction of 0.5 marks. The Candidate securing 50% marks in VPCE will pass this part of exam

Declaration of Result



The Candidate will have to score 50% marks in written and video-projected clinical components and a cumulative score of 60% to be declared successful in the Abridged Examination.

A maximum total of four consecutive attempts (availed or unavailed) will be allowed in the Abridged Examination during which the candidate will be allowed to continue his training program. If the candidate fails to pass his Abridged Examination within the above mentioned limit of four attempts, the candidate shall be removed from the training program, and the seat would fall vacant, stipend/ scholarship if any would be stopped.



Final Examination

All candidates admitted in MD Radiology course shall appear in Final (clinical) examination at the end of structured training programme (end of 4th calendar year), and having passed the Abridged examination.

Eligibility Criteria:

To appear in the Final Examination the candidate shall be required:

- i) To have submitted the result of passing Abridged Examination.
- ii) To have submitted the certificate of completion of training, issued by the Supervisor will be mandatory.
- iii) To have achieved a cumulative score of 75% in Continuous Internal assessments of all training years.
- iv) To have got the thesis accepted and will then be eligible to appear in Final Examination.
- v) To have submitted no dues certificate from all relevant departments including library, hostel, cashier etc.
- vi) To have submitted evidence of submission of examination fee.

Final Examination Schedule and Fee

- a) Final examination will be held twice a year.



- b) The candidates have to satisfy eligibility criteria before permission is granted to take the examination.
- c) Examination fee will be determined and varied at periodic intervals by the University.
- d) The examination fee once deposited cannot be refunded / carried over to the next examination under any circumstances.
- e) The Controller of Examinations will issue an Admittance Card with a photograph of the candidate on receipt of prescribed application form, documents satisfying eligibility criteria and evidence of payment of examination fee. This card will also show the Roll Number, date / time and venue of examination.

Components of Final Examination

Written Part of Final Examination	Total marks 500
Clinical, TOACS/OSCE & ORAL	Total marks 500
Contribution of CIS to the Final Examination	Total marks 100
Thesis Evaluation	Total marks 400

Written Part of Final Examination

- a) There shall be two written papers which will cover the whole syllabus of the specialty of training with total marks of 500.
- b) The written examination will consist of 200 single best answer type Multiple Choice Questions (MCQs) and 10 Short Essay Questions (SEQs). Each correct answer in the Multiple Choice Question paper will



carry 02 marks, but an incorrect response will result in deduction of 0.5 mark. Each Short Essay Question will carry 10 marks.

c) The Total Marks of the Written Examination will be 500 to be divided as follows:

- Multiple Choice Question paper Total Marks = 400
- Short Essay Question paper Total Marks = 100

d) The candidates scoring a score of 50% marks in multiple choice question paper and short essay question paper will pass the written part of the final examination and will become eligible to appear in the clinical and oral examination.

e) The written part result will be valid for three consecutive attempts for appearing in the Clinical and Oral Part of the Final Examination. After that the candidate have to re-sit the written part of the Final Examination.

Clinical. TOACS/OSCE & ORAL:

a) The Clinical and Toacs/OSCE & Oral will consist of 04 short cases, 01 long case and Oral Examination with 01 station for a pair of Internal and External Examiner Each short case will be of 07 minutes duration, 05 minutes will be for examining the patient and 02 minutes for discussion. The Oral Examination will consist of laboratory data assessment, interpretation of Radiology images, ECG and others.



- b) The Total Marks of Clinical and Toacs/OSCE & Oral will be 500 and to be divided as follows:

Short Cases	Total Marks = 200
Long Case	Total Marks = 100
TOACS/OSCE & ORAL	Total Marks = 200

- c) A panel of four examiners will be appointed by the Vice Chancellor and of these two will be from university whilst the other two will be the external examiners. Internal examiner will act as a coordinator. In case of difficulty in finding an Internal examiner in a given subject, the Vice Chancellor would, in consultation with the concerned Deans, appoint any relevant person with appropriate qualification and experience, outside the University as an examiner.
- d) The internal examiners will not examine the candidates for whom they have acted as Supervisor and will be substituted by other internal examiner.
- e) The candidates scoring 50% marks in each component of the Clinical & Oral Examination will pass this part of the Final Examination.
- f) The candidates will have two attempts to pass the final examination with normal fee. A special administration fee of Rs.10,000 in addition to normal fee or the amount determined by the University from time to time shall be charged for further attempts.



1. There shall be two written papers of 250 marks each.
2. Both papers shall have problem-based short/modified essay questions and MCQs.

Paper 1

MCQs 100(2 marks each)
SEQs 5 (10 marks each)

Paper 2

MCQs 100(2 marks each)
SEQs 5 (10 marks each)

4. Clinical, TOACS/OSCE & ORAL shall have 500 marks for:
 - i. 1 Long Case 100 Marks
 - ii. 4 Short Cases 200 Marks
 - iii. Clinical, TOACS/OSCE & ORAL 200 Marks

Declaration of Result

For the declaration of result

- I. The candidate must get his/her Thesis accepted.
- II. The candidate must have passed the final written examination with 50% marks and the clinical & oral examination securing 50% marks. The cumulative passing score from the written and clinical/ oral examination shall be 60%. Cumulative score of 60% marks to be calculated by adding up secured marks of each component of the Examination i.e written and clinical/ oral and then calculating its percentage.



- III. The MD degree shall be awarded after acceptance of thesis and success in the final examination.
- IV. On completion of stipulated training period, irrespective of the result (pass or fail) the training slot of the candidate shall be declared vacant.



Submission / Evaluation of Synopsis

1. The candidates shall prepare their synopsis as per guidelines provided by the Advanced Studies & Research Board, available on university website.
2. The research topic in clinical subject should have 30% component related to basic sciences and 70% component related to applied clinical sciences. The research topic must consist of a reasonable sample size and sufficient numbers of variables to give training to the candidate to conduct research, to collect & analyze the data.
3. Synopsis of research project shall be submitted by the end of the 2nd year of MD program. The synopsis after review by an Institutional Review Committee shall be submitted to the University for consideration by the Advanced Studies & Research Board, through the Principal / Dean /Head of the institution.

Submission of Thesis

1. Thesis shall be submitted by the candidate duly recommended by the Supervisor.
2. The minimum duration between approval of synopsis and submission of thesis shall be one year.
3. The research thesis must be compiled and bound in accordance with the Thesis Format Guidelines approved by the University and available on website.
4. The research thesis will be submitted along with the fee prescribed by the University.



Thesis Examination

- a) The candidate will submit his/her thesis at least 06 months prior to completion of training.
- b) The Thesis along with a certificate of approval from the supervisory will be submitted to the Registrar's office, who would record the date /

time etc. and get received from the Controller of Examinations within 05 working days of receiving.

- c) The Controller of Examinations will submit a panel of eight examiners within 07 days for selection of four examiners by the Vice Chancellor. The Vice Chancellor shall return the final panel within 05 working days to the Controller of Examinations for processing and assessment. In case of any delay the Controller of Examinations would bring the case personally to the Vice Chancellor.
- d) The Supervisor shall not act as an examiner of the candidate and will not take part in evaluation of thesis.
- e) The Controller of Examinations will make sure that the Thesis is submitted to examiners in appropriate fashion and a reminder is sent after every ten days.
- f) The thesis will be evaluated by the examiners within a period of 06 weeks.
- g) In case the examiners fail to complete the task within 06 weeks with 02 fortnightly reminders by the Controller of Examinations, the Controller of Examinations will bring it to the notice of Vice Chancellor in person.



- h) In case of difficulty in find an internal examiner for thesis evaluation, the Vice Chancellor would, in consultation with the concerned Deans, appoint any relevant person as examiner in supersession of the relevant Clause of the University Regulations.
- i) There will be two internal and two external examiners. In case of difficulty in finding examiners, the Vice Chancellor would, in consultation with the concerned Deans, appoint minimum of three, one internal and two external examiners.
- j) The total marks of thesis evaluation will be 400 and 60% marks will be required to pass the evaluation.
- k) The thesis will be considered / accepted, if the cumulative score of all the examiners is 60%.
- l) The clinical training will end at completion of stipulated training period but the candidate will become eligible to appear in the Final

Examination at completion of clinical training and after acceptance of thesis. In case clinical training ends earlier, the slot will fall vacant after stipulated training period.

Award of MD Radiology Degree

After successful completion of the structured courses of MD Radiology and qualifying Abridged and Final examinations (Written, Clinical, TOACS/OSCE & ORAL and Thesis), the degree with title MD Radiology shall be awarded.



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CONTENT OUTLINE

MD Radiology

After 6 months of Induction period in Radiology, the resident shall undergo training in principals of Internal Medicine and General Surgery each for 3 months as follows:-

1. Principles of Internal Medicine

- Medical ethics
- Professional values, student teachers relationship
- Orientation of in-patient, out-patients and neurology labs
- Approach to the patient
- History taking
- General physical examination
- Systemic examination
- Routine investigations
- Special investigations
- Diagnostic and therapeutic procedures

Course Contents:

1. Cardiovascular Medicine

Common and / or important Cardiac Problems:

- Arrhythmias
- Ischaemic Heart Disease: acute coronary syndromes, stable angina, atherosclerosis
- Heart Failure
- Hypertension – including investigation and management of accelerated hypertension
- Valvular Heart Disease



- Endocarditis
- Aortic dissection
- Syncope
- Dyslipidaemia

Clinical Science:

- Physiological principles of cardiac cycle and cardiac conduction
- Pharmacology of major drug classes: beta blockers, alpha blockers, ACE inhibitors, Angiotensin receptor blockers (ARBs), anti-platelet agents, thrombolysis, inotropes, calcium channel antagonists, potassium channel activators, diuretics, anti-arrhythmics, anticoagulants, lipid modifying drugs, nitrates, centrally acting anti-hypertensives

2. Dermatology;

Common and / or Important Problems:

- Cellulitis
- Cutaneous drug reactions
- Psoriasis and eczema
- Skin failure: eg erythroderma, toxic epidermal necrolysis
- Urticaria and angio-oedema
- Cutaneous vasculitis
- Herpes zoster and Herpes Simplex infections
- Skin tumours
- Skin infestations
- Dermatomyositis
- Scleroderma
- Lymphoedema

Clinical Science:

- Pharmacology of major drug classes: topical steroids, immunosuppressants

3. Diabetes & Endocrine Medicine

Common and / or Important Diabetes Problems:

- Diabetic ketoacidosis
- Non-acidotic hyperosmolar coma / severe hyperglycaemia
- Hypoglycaemia
- Care of the acutely ill diabetic
- Peri-operative diabetes care

Common or Important Endocrine Problems:

- Hyper/Hypocalcaemia

- Adrenocortical insufficiency
- Hyper/Hyponatraemia
- Thyroid dysfunction
- Dyslipidaemia
- Endocrine emergencies: myxoedemic coma, thyrotoxic crisis, Addisonian crisis, hypopituitary coma, pheochromocytoma crisis

Clinical Science:

- Outline the function, receptors, action, secondary messengers and feedback of hormones
- Pharmacology of major drug classes: insulin, oral anti-diabetics, thyroxine, anti-thyroid drugs, corticosteroids, sex hormones, drugs affecting bone metabolism

4. Gastroenterology and Hepatology

Common or Important Problems:

- Peptic Ulceration and Gastritis
- Gastroenteritis
- GI malignancy (oesophagus, gastric, hepatic, pancreatic, colonic)
- Inflammatory bowel disease
- Iron Deficiency anaemia
- Acute GI bleeding
- Acute abdominal pathologies: pancreatitis, cholecystitis, appendicitis, leaking abdominal aortic aneurysm
- Functional disease: irritable bowel syndrome, non-ulcer dyspepsia
- Coeliac disease
- Alcoholic liver disease
- Alcohol withdrawal syndrome
- Acute liver dysfunction: jaundice, ascites, encephalopathy
- Liver cirrhosis
- Gastro-oesophageal reflux disease
- Nutrition: indications, contraindications and ethical dilemmas of nasogastric feeding and EG tubes, IV nutrition, re-feeding syndrome
- Gall stones
- Viral hepatitis
- Auto-immune liver disease
- Pancreatic cancer

Clinical Science:

- Laboratory markers of liver, pancreas and gut dysfunction

- Pharmacology of major drug classes: acid suppressants, anti-spasmodics, laxatives, anti-diarrhoea drugs, aminosalicylates, corticosteroids, immunosuppressants, infliximab, pancreatic enzyme supplements

5. Renal Medicine

Common and / or Important Problems:

- Acute renal failure
- Chronic renal failure
- Glomerulonephritis
- Nephrotic syndrome
- Urinary tract infections
- Urinary Calculus
- Renal replacement therapy
- Disturbances of potassium, acid/base, and fluid balance (and appropriate acute interventions)

Clinical Science:

- Measurement of renal function
- Metabolic perturbations of acute, chronic, and end-stage renal failure and associated treatments

6. Respiratory Medicine

Common and / or Important Respiratory Problems:

- COPD
- Asthma
- Pneumonia
- Pleural disease: Pneumothorax, pleural effusion, mesothelioma
- Lung Cancer
- Respiratory failure and methods of respiratory support
- Pulmonary embolism and DVT
- Tuberculosis
- Interstitial lung disease
- Bronchiectasis
- Respiratory failure and cor-pulmonale
- Pulmonary hypertension

Clinical Science:

- Principles of lung function measurement
- Pharmacology of major drug classes: bronchodilators, inhaled corticosteroids, leukotriene receptor antagonists, immunosuppressants

7. Allergy

Common or Important Allergy Problems

- Anaphylaxis
- Recognition of common allergies; introducing occupation associated allergies
- Food, drug, latex, insect venom allergies
- Urticaria and angioedema

Clinical Science

- Mechanisms of allergic sensitization: primary and secondary prophylaxis
- Natural history of allergic diseases
- Mechanisms of action of anti-allergic drugs and immunotherapy
- Principles and limitations of allergen avoidance

8. Haematology

Common and / or Important Problems:

- Bone marrow failure: causes and complications
- Bleeding disorders: DIC, haemophilia
- Thrombocytopaenia
- Anticoagulation treatment: indications, monitoring, management of over-treatment
- Transfusion reactions
- Anaemia: iron deficient, megaloblastic, haemolysis, sickle cell,
- Thrombophilia: classification; indications and implications of screening
- Haemolytic disease
- Myelodysplastic syndromes
- Leukaemia
- Lymphoma
- Myeloma
- Myeloproliferative disease
- Inherited disorders of haemoglobin (sickle cell disease, thalassaemias)
- Amyloid

Clinical Science:

- Structure and function of blood, reticuloendothelial system, erythropoietic tissues

9. Immunology

Common or Important Problems:

- Anaphylaxis (see also 'Allergy')



Clinical Science:

- Innate and adaptive immune responses
- Principles of Hypersensitivity and transplantation

10. Infectious Diseases

Common and / or Important Problems:

- Fever of Unknown origin
- Complications of sepsis: shock, DIC, ARDS
- Common community acquired infection: LRTI, UTI, skin and soft tissue infections, viral exanthema, gastroenteritis
- CNS infection: meningitis, encephalitis, brain abscess
- HIV and AIDS including ethical considerations of testing
- Infections in immuno-compromised host
- Tuberculosis
- Anti-microbial drug monitoring
- Endocarditis
- Common genito-urinary conditions: non-gonococcal urethritis, gonorrhoea, syphilis

Clinical Science:

- Principles of vaccination
- Pharmacology of major drug classes: penicillins, cephalosporins, tetracyclines, aminoglycosides, macrolides, sulphonamides, quinolones, metronidazole, anti-tuberculous drugs, anti-fungals, anti-malarials, anti-helminthics, anti-virals

11. Medicine in the Elderly

Common or Important Problems:

- Deterioration in mobility
- Acute confusion
- Stroke and transient ischaemic attack
- Falls
- Age related pharmacology
- Hypothermia
- Continence problems
- Dementia
- Movement disorders including Parkinson's disease
- Depression in the elderly



- Osteoporosis
- Malnutrition
- Osteoarthritis

Clinical Science:

- Effects of ageing on the major organ systems
- Normal laboratory values in older people

12. Musculoskeletal System

Common or Important Problems:

- Septic arthritis
- Rheumatoid arthritis
- Osteoarthritis
- Seronegative arthritides
- Crystal arthropathy
- Osteoporosis - risk factors, and primary and secondary prevention of complications of osteoporosis
- Polymyalgia and temporal arteritis
- Acute connective tissue disease: systemic lupus erythematosus, scleroderma, poly- and dermatomyositis, Sjogren's syndrome, vasculitides

Clinical Science:

- Pharmacology of major drug classes: NSAIDs, corticosteroids, immunosuppressants, colchicines, allopurinol, bisphosphonates

13. Psychiatry

Common and /or Important Problems:

- Suicide and parasuicide
- Acute psychosis
- Substance dependence
- Depression

Clinical Science:

- Principles of substance addiction, and tolerance
- Pharmacology of major drug classes: anti-psychotics, lithium, tricyclic antidepressants, mono-amine oxidase inhibitors, SSRIs, venlafaxine, donepezil, drugs used in treatment of addiction (bupropion, disulpharam, acamprosate, methadone)

14. Cancer and Palliative Care

Common or Important Oncology Problems:

- Hypercalcaemia
- SVC obstruction
- Spinal cord compression
- Neutropenic sepsis
- Common cancers (presentation, diagnosis, staging, treatment principles): lung, bowel, breast, prostate, stomach, oesophagus, bladder)

Common or Important Palliative Care Problems:

- Pain: appropriate use, analgesic ladder, side effects, role of radiotherapy
- Constipation
- Breathlessness
- Nausea and vomiting
- Anxiety and depressed mood

Clinical Science:

- Principles of oncogenesis and metastatic spread
- Apoptosis
- Principles of staging
- Principles of screening
- Pharmacology of major drug classes in palliative care: anti-emetics, opioids, NSAIDs, agents for neuropathic pain, bisphosphonates, laxatives, anxiolytics

15. Clinical Genetics

Common and / or Important problems:

- Down's syndrome
- Turner's syndrome
- Huntington's disease
- Haemochromatosis
- Marfan's syndrome
- Klinefelter's syndrome
- Familial cancer syndromes
- Familial cardiovascular disorders

Clinical Science:

- Structure and function of human cells, chromosomes, DNA, RNA and cellular proteins
- Principles of inheritance: Mendelian, sex-linked, mitochondrial
- Principles of pharmacogenetics
- Principles of mutation, polymorphism, trinucleotide repeat disorders
- Principles of genetic testing including metabolite assays, clinical examination and analysis of nucleic acid (e.g. PCR)

16. Clinical Pharmacology

Common and / or Important problems:

- Corticosteroid treatment: short and long-term complications, bone protection, safe withdrawal of corticosteroids, patient counselling regarding avoid adrenal crises
- Specific treatment of poisoning with:
 - Aspirin,
 - Paracetamol
 - Tricyclic anti-depressants
 - Beta-blockers
 - Carbon monoxide
 - Opiates
 - Digoxin
 - Benzodiazepines

Clinical Science:

- Drug actions at receptor and intracellular level
- Principles of absorption, distribution, metabolism and excretion of drugs
- Effects of genetics on drug metabolism
- Pharmacological principles of drug interaction
- Outline the effects on drug metabolism of: pregnancy, age, renal and liver impairment

Investigation Competencies

Outline the Indications for, and Interpret the Following Investigations:

- Basic blood biochemistry: urea and electrolytes, liver function tests, bone biochemistry, glucose, magnesium
- Cardiac biomarkers and cardiac-specific troponin
- Creatine kinase
- Thyroid function tests
- Inflammatory markers: CRP / ESR
- Arterial Blood Gas analysis
- Cortisol and short Synacthen test
- HbA1C
- Lipid profile
- Amylase



- Full blood count
- Coagulation studies
- Haemolysis studies
- D dimer
- Blood film report
- Blood / Sputum / urine culture
- Fluid analysis: pleural, cerebro-spinal fluid, ascitic
- Urinalysis and urine microscopy
- Auto-antibodies
- Chest radiograph
- Abdominal radiograph
- Joint radiographs (knee, hip, hands, shoulder, elbow, dorsal spine, ankle)
- ECG
- Peak flow tests
- Full lung function tests

More Advanced Competencies;

- Ultrasound
- Detailed imaging: CT Neuroangiography, high resolution CT, MRI
- Echocardiogram
- 24 hour ECG monitoring
- Ambulatory blood pressure monitoring
- Neurophysiological studies: EMG, nerve conduction studies, visual and auditory evoked potentials

Procedural Competencies

- The trainee is expected to be competent in performing the following procedures by the end of core training. The trainee must be able to outline the indications for these interventions. For invasive procedures, the trainee must recognize the indications for the procedure, the importance of valid consent, aseptic technique, safe use of local anaesthetics and minimization of patient discomfort.
- Venepuncture
- Cannula insertion, including large bore
- Arterial blood gas sampling
- Lumbar Puncture
- Pleural tap and aspiration
- Central venous cannulation

- Initial airway protection: chin lift, Guedel airway, nasal airway, laryngeal mask
- Basic and, subsequently, advanced cardiorespiratory resuscitation
- Cytology: pleural fluid, ascitic fluid, cerebro-spinal fluid, sputum
- Urethral catheterization
- Nasogastric tube placement and checking

2. Principles of General Surgery

- History of surgery
- Preparing a patient for surgery
- Principles of operative surgery: asepsis, sterilization and antiseptics
- Surgical infections and antibiotics
- Basic principles of anaesthesia and pain management
- Acute life support and critical care:
 - Pathophysiology and management of shock
 - Fluids and electrolyte balance/ acid base metabolism
 - Haemostasis, blood transfusion
- Trauma: assessment of polytrauma, triage, basic and advanced trauma
- Accident and emergency surgery
- Wound healing and wound management
- Nutrition and metabolism
- Principles of burn management
- Principles of surgical oncology
- Principles of laparoscopy and endoscopy
- Organ transplantation
- Informed consent and medicolegal issues
- Molecular biology and genetics



- Operative procedures for common surgical manifestations e.g cysts, sinuses, fistula, abscess, nodules, basic plastic and reconstructive surgery
- Principles of basic diagnostic and interventional radiography
- Principles and interpretation of conventional and advanced radiographic procedures

Common Surgical Skills

Incision of skin and subcutaneous tissue:

- Langer's lines
- Healing mechanism
- Choice of instrument
- Safe practice

Closure of skin and subcutaneous tissue:

- Options for closure
- Suture and needle choice
- Safe practice

Knot tying:

- Choice of material
- Single handed
- Double handed
- Superficial
- Deep

Tissue retraction:

- Choice of instruments
- Placement of wound retractors
- Tissue forceps

Use of drains:

- Indications
- Types
- Insertion
- Fixation
- Management/removal

Incision of skin and subcutaneous tissue:

- Ability to use scalpel, diathermy and scissors

Closure of skin and subcutaneous tissue:

- Accurate and tension free apposition of wound edges

Haemostasis:

- Control of bleeding vessel (superficial)
- Diathermy
- Suture ligation
- Tie ligation
- Clip application
- Plan investigations
- Clinical decision making
- Case work up and evaluation; risk management

Pre-operative assessment and management:

- Cardiorespiratory physiology
- Diabetes mellitus
- Renal failure
- Pathophysiology of blood loss
- Pathophysiology of sepsis
- Risk factors for surgery
- Principles of day surgery
- Management of comorbidity

Intraoperative care:

- Safety in theatre
- Sharps safety
- Diathermy, laser use
- Infection risks
- Radiation use and risks
- Tourniquets
- Principles of local, regional and general anaesthesia

Post-operative care:

- Monitoring of postoperative patient
- Postoperative analgesia
- Fluid and electrolyte management
- Detection of impending organ failure
- Initial management of organ failure
- Complications specific to particular operation
- Critical care

Blood products:

- Components of blood
- Alternatives to use of blood products



- Management of the complications of blood product transfusion including children

Antibiotics:

- Common pathogens in surgical patients
- Antibiotic sensitivities
- Antibiotic side-effects
- Principles of prophylaxis and treatment

Safely assess the multiply injured patient:

- History and examination
- Investigation
- Resuscitation and early management
- Referral to appropriate surgical subspecialties

Technical Skills

- Central venous line insertion
- Chest drain insertion
- Diagnostic peritoneal lavage
- Bleeding diathesis & corrective measures, e.g. warming, packing
- Clotting mechanism; Effect of surgery and trauma on coagulation
- Tests for thrombophilia and other disorders of coagulation
- Methods of investigation for suspected thromboembolic disease
- Anticoagulation, heparin and warfarin
- Role of V/Q scanning, CT angiography and thrombolysis
- Place of pulmonary embolectomy
- Awareness of symptoms and signs associated with pulmonary embolism and DVT
- Role of duplex scanning, venography and d-dimer measurement
- Initiate and monitor treatment

Diagnosis and Management of Common Surgical Conditions:

- Abdominal pain
- Vomiting
- Trauma
- Groin conditions
 - Hernia
 - Hydrocoele
 - Penile inflammatory conditions
 - Undescended testis
 - Acute scrotum



- Abdominal wall pathologies
- Urological conditions
- Constipation
- Head / neck swellings
- Intussusception
- Abscess
- In growing toenail

In terms of general experience it is expected that trainees would have gained exposure to the following procedures and to be able to perform those marked (*) under direct supervision.

- Elective Procedures
 - Inguinal hernia
- (not neo-natal)
 - Orchidopexy
 - Circumcision*
 - Lymph node biopsy*
 - Abdominal wall herniae
 - Insertion of CV lines
 - Management of in growing toenails*
 - EUA rectum*
 - Manual evacuation*
 - Open rectal biopsy
 - Excision of skin lesions*
- Emergency Procedures
 - Appendicectomy
 - Incision and drainage of abscess*
 - Pyloromyotomy
 - Operation for testicular torsion*
 - Insertion of pleural drain*
 - Insertion of suprapubic catheter*
 - Reduction of intussusception

3. PHYSICS

Introduction

- General properties of radiation and matter
- Fundamentals of nuclear physics and radioactivity

- Structure of the atom
- Definition of atomic number, mass number, nuclide, isotope and electron volt

Electromagnetic radiation

- Spectrum
- General properties, wave and quantum theories

Radioactivity

- Exponential decay
- Specific activity
- Physical, biological and effective half- life
- Properties of radioactive materials
- Radioactive decay schemes
- Units of activity
- Half life
- Properties of radiations - alpha, beta, gamma
- Basic knowledge of reactors

Production of X-rays

- Principles
- Essential components of x - ray tubes
- Continuous spectra
- Characteristic radiation
- Factors' controlling the nature of x - ray emission

Tube rating

- Stationary and rotating anodes
- Heat capacity
- Methods of cooling
- Effect of focal spot size
- Exposure time
- Voltage wave form
- Multiple exposures
- Failing load operation,
- Exposure timers
- Automatic exposure control

Interaction

- Interaction of X - rays and gamma rays with matter and their effects on the irradiated materials
- Interaction processes and their relative importance for various materials and at different radiation energies

- Attenuation, absorption, scatter, exponential law, attenuation coefficients, half- value thickness.
- Homogeneous and heterogeneous radiation contrast
- Effects: heat, excitation, ionization, range of secondary electrons, chemical, photographic, fluorescent, phosphorescent, thermo luminescent

Measurement of X and gamma rays

- Quantity: ionization, TLD, and photographic dosimetry
- Exposure: absorbed dose, and the relationship between them and radiation energy
- Exposure and exposure rate meters
- Geiger -Muller and scintillation detectors
- Radionuclide detection measurement
- Counting statistics.
- Quality: radiation, beam energy, mean, effective and peak energy, half value thickness and filtration

Interaction of X rays with the patient

- Attenuation in various body tissues, high voltage radiography mammography, enhancement by contrast media.
- Geometric factors: magnification, distortion, positioning geometric grid movement unsharpness, obliteration, micro- radiography, beam limitation, focal spot size

The radiological image

Image quality: description and meaning, resolution, noise, definition and contrast

The image receptor

- Intensifying screens: construction, physical principles and applications
- X ray film : structure and operation
- Characteristic curve
- Density
- Speed
- Contrast
- Latitude
- Processing and the dark room
- Automatic x ray film processor
- Functions
- Principles

- Construction
- Advantages and disadvantages
- Handling and storage
- Labeling and identification
- Design and care of cassettes
- Display and perception of the radiographic image
- Image intensities: construction, operation, brightness gain, optical couplings, tv systems.
- Recording media': 35 mm cine film, 100 mm or 60mm spot film, video tape /disc
- Electrostatic processes: xeroradiography.

Scattered radiation

- Effect and control scatter
- Beam limitation
- Compression
- grid construction and operation
- Radiographic subtraction techniques
- Tomography (conventional) : principles, layer thickness
- Digital fluoroscopic systems: data collection, storage and display including digital subtraction techniques, implication of digital storage media

Radiation Protection

- Biological effects of radiation, risks of somatic and genetic effects. Objectives of radiation protection.
- Recommendations of I.C.R.P
- Concepts of dose equivalent quality factor, detriment limitation
- Annual limits of intake
- Radio logical protection regulations
- Relevant codes of practice
- Dose control by design and by operation in diagnostic X ray procedures and nuclear medicine for both staff and patients.
- Doses received in diagnostic procedures
- Population, somatic and genetic dose
- Risk estimates
- Benefits
- Personnel monitoring.

Quality assurance

- Methods of assessing image quality and their relationship to specifications of system performance
- Methods of monitoring equipment performance

Specialty training in Radiology

Specific Program Content

1. Specialized training in Radiology
2. Compulsory rotations
3. Research & thesis writing
4. Maintaining of Log-book

1. Specialized training in Radiology

2nd Year of the Programme:

- General Radiography
- Special Investigations
- Contrast Media and Pharmacological Aids to Radiology
- Radiological Emergencies

3rd Year of the Programme:

- Radiological manifestations of disease of the body systems with all diagnostic modalities

4th Year of the Programme:



- Radiology in relation to clinical problems

Course Outlines:

General Radiology:

- The photographic process
- Characteristics of x-ray film
- Fluorescent and intensifying screens
- X-ray exposure factors
- Definition and image quality
- Camera and lenses
- The x-ray dark room
- Film labeling and identification
- Standard radiographic projection relating to the regions outlined
- In radiological anatomy syllabus.
- Positioning of patient and patient radiation protection.
- Correction of errors in centering and exposure.
- Soft tissue radiography — mammography.
- Magnification radiographic techniques.
- Localization techniques particularly foreign bodies in eye
- Tomography — general principles.
- Contrast investigations including barium examination
- Radioisotope examination
- Ultrasound examination
- Computed tomography
- Radiological investigations are:
- Indications and contra- indications
- Preparation required
- Apparatus e.g a. Fluoroscopic equipments
- Choice of ultrasound transducer, etc.
- Contrast media and pharmacological aids to radiology
- Alternative approach
- Complications of radiological procedures
- Chemical composition and classification of contrast media
- Mode of administration and its clinical uses
- Routes of elimination



- Relative advantage of different types of media
- Physiological responses and adverse reactions to contrast-media and their treatment.
- Drugs commonly used in radiological practice
- Preparations of the bowel, purgatives and colonic activators
- Sedation before radiological procedures
- Prophylaxis and treatment of reactions to radiological procedures other than to contrast, e.g. in phaeochromocytoma
- Drugs modifying the behavior of the gastrointestinal tract during investigations

CLINICAL RADIOLOGY

CHEST RADIOLOGY:

- The chest wall, diaphragm and pleura
- Collapse and consolidation
- Inflammatory diseases of the lung
- Chronic bronchitis and emphysema
- Occupational diseases
- Tumour of the lung
- pulmonary disease of unknown aetiology
- Pulmonary disease with an immunological basis
- Pulmonary collagen diseases
- Mediastinal lesions
- Chest trauma
- Post operative chest
- Intensive care chest

CARDIOVASCULAR RADIOLOGY

- The pericardium
- The pulmonary circulation
- Acquired heart disease
- Congenital heart disease
- Vascular disease:
 - Arterial
 - Venous
 - Lymphatic

MUSCULOSKELETAL RADIOLOGY:

- Congenital skeletal anomalies
- Dysplasia of bone
- Chromosomal disorders
- Periosteal reaction
- Bone and joint infection
- Avascular necrosis of bone
- Diseases of joints
- Tumours and tumour-like lesions of bone
- Disorders of lymphoreticular system and other haemopoietic disorders
- Skeletal disorders of metabolic and endocrine origin
- Skeletal trauma
- Miscellaneous bone lesion, e.g., Paget's disease, etc.

GASTROINTESTINAL RADIOLOGY:

- The salivary glands
- Pharynx and oesophagus
- The stomach and duodenum
- The small bowel
- The colon
- The acute abdomen
- The biliary tract
- The liver, spleen and pancreas
- The adrenal glands

GENITOURINARY RADIOLOGY:

- Congenital lesion
- Cystic disease of the kidney
- Tumour of the kidney
- Renal calculi and nephrocalcinosis
- Urinary tract infection
- Renal vascular disease
- Disorders of the ureters, bladder, prostate and urethra
- Marginal and disease of scrotal content
- Gynecologic radiology
- Obstetric radiology



BREAST IMAGING:

- Requirements and standards for Mammography
- Mammographic Interpretation
- Pathologic and mammographic appearance and clinical significance of benign breast conditions
- Atypical ductal hyperplasia (ADH), lobular neoplasia (LCIS) and other histologic risk factors.
- Pathologic and mammographic appearance, clinical features significance, and prognosis of malignant breast disorders
- Mammography quality control
- Mammographic appearance of artifacts such as roller marks, grid lines, motion unsharpness, noise, dust, poor screen-film contact, pickoff and scratches.
- Breast Ultrasound
- Need for correlation with mammography.
- Ultrasound guided core biopsy and/or FNA. Importance of correlation of pathologic, mammographic and sonographic findings and history in determining patient management.
- Galactography.

NEURORADIOLOGY:

- The normal skull
- Vascular, infectious, inflammatory, space occupying lesions of the cranial cavity
- Disease of the brain
- Vascular disease of the brain
- Disease of the spine

HEAD AND NECK RADIOLOGY

- Imaging Modalities (including current indications, radiation dose, use of intravenous contrast)
- Plain film radiography, including barium swallow
- Percutaneous and transvenous or transarterial interventions
- Biopsy; Ultrasound, CT or MR guided
- The petrous temporal bone
- Temporomandibular joint
- Nose and Paranasal Sinuses
- Midface



- The orbit and eye
- Esophagus
- Sialography
- Teeth and jaws
- Dentascan - technique, anatomy, implant technology
- Oral cavity - tongue, floor of mouth, retromolar trigone
- The pharynx and larynx

EMERGENCY RADIOLOGY:

- Evaluation of the emergency radiographic examinations
- Medicolegal (MLC) procedures
- Radiography in emergency patients and review and interpretation of radiographs
- Indications for and limitations of the common emergency imaging procedures
- Findings, diagnosis and other relevant information to the emergency room physician
- Special imaging procedures needed in emergency room e.g.; barium studies, excretory urography, CT, ultrasound, Doppler and angiography
- Investigations (both conventional and newer methods), interpretation of the results and diagnosis/ differential diagnosis based on the clinical and biochemical results
- Common procedures performed in the department (e.g.; thyroid, kidney, bone, cardiac scans), understand the principle underlying the procedure and the basis for using a particular isotope in an investigation

PAEDIATRIC RADIOLOGY:

- Airways on chest x-ray of the infant or older child
- Abnormalities associated with congenital heart disease on the chest radiograph of the infant/older child
- Normal vs. abnormal skeletal structures (esp. extremities on a bone survey)
- Proper procedure for fluoroscopy of an infant/older child
- Bone age on the basis of radiographic findings
- Positioning techniques and technical factors leading to optimum chest, GU radiographs of the infant and older child
- Bone age on the basis of radiographic findings
- Chest radiology and congenital diseases of the heart

- Normal vs. abnormal findings on skeletal, skull (and contents), and spine radiographs

VASCULAR AND INTERVENTIONAL RADIOLOGY:

- Seldinger technique to obtain non-selective arterial access in normal and diseased arteries
- Seldinger technique to obtain non-selective venous access
- Selective and super-selective arterial and venous catheterizations
- Appropriate injection and filming procedures for all selective and non-selective vascular diagnostic examinations
- Basic and advanced guide wire exchange techniques
- Local anesthesia
- Conscious sedation
- Vascular and nonvascular procedures for diagnostic and therapeutic purposes
- Non-functioning or poorly functioning vascular access devices and drains
- Risks, benefits, indications, and contraindications of VIR procedures
- Drugs used in VIR procedures including analgesics, anti-anxiety agents, vasodilator drugs, thrombolytic agents and antibiotics
- Basics of iodinated contrast, including alternatives to standard agents
- Common and uncommon vascular normal variants
- Pathophysiology of all diseases particularly peripheral vascular disease, renovascular hypertension, carotid occlusive disease, venous thromboembolic disease, biliary and genitourinary obstruction and abscesses
- Indications, basic technique, tools, results, complications and outcomes of percutaneous transluminal angioplasty of arteries and veins
- Use of vascular stents including results
- Basic principles and utility of vascular ultrasound
- Basic and advanced principles of thrombolysis
- Percutaneous biliary and urinary drainage, including strategies for internal drainage using stents
- TIPS procedure, including indications, contraindications and results
- Thrombolysis and PTA in dialysis access
- Principles of venous access including PICCs, tunneled catheters and dialysis catheters
- Basic principles of MRA, CTA, and vascular ultrasound Discuss indications for and contraindications to inferior vena caval filter placement, as well as advantages and disadvantages of various available filters



RADIATION PROTECTION:

- X-ray tube and imaging
- General Radiography X-ray facility
- Fluoroscopy X-ray equipment
- Interventional radiology
- Computed tomography (CT)
- Mammography
- Pediatric radiology
- Dental practice
- Radiation Protection Programme in Diagnostic Radiology
- Organizational structure of radiation protection in a typical diagnostic radiology department
- Persons and groups involved in a radiation protection program
- Legal Person(Licensee/Registrant)
- Radiation Protection Committee
- Inspections and audits
- Design, layout and shielding in a diagnostic and interventional radiology department
- Radiation protection of staff
- Working environment
- Personal safety and monitoring
- Radiation protection of patients
- Safe design criteria for equipment
- Risks of diagnostic and interventional radiology treatment for the patient (side effects)
- Techniques to reduce dose
- Diagnostic reference levels (Guidance levels)
- Persons supporting the patient
- Reporting of incidents and accidents
- Radiation protection of the public
- Review of facility design
- Designation of areas
- Documentation of procedures and record keeping
- ISO and IEC Standards
- Treatment documentation
- Log books
- Access to information



- Electronic storage devices
- Audits
- Accidents and incidents
- Potential exposures in the different stages of the installation, acceptance and operation
- Case Studies of accidental and incidental exposures
- Reporting and dissemination of information
- The need for training and drills
- Education and Training
- Updating of education and training
- Accreditation of training and courses
- Quality management
- Quality assurance and quality control
- Concepts of QA and its application to radiation protection in diagnostic and interventional radiology
- Patient related QA
- Equipment selection, installation and commissioning
- Maintenance
- Organization and administration – the responsibility of the user
- The role of different professions
- External checks
- Practical sessions will cover exercises related to "Authorization for the possession"

NUCLEAR RADIOLOGY:

- Clinical indications, general procedures (including radiopharmaceutical and dose), and scintigraphic findings in:
 - Pulmonary (emboli) ventilation and perfusion imaging
 - Hepatobiliary imaging and functional studies
 - GI tract imaging and functional studies
 - GI blood loss imaging
 - Bone imaging
 - Renal and urinary tract studies
 - Thyroid imaging and functional studies
 - Brain imaging and functional studies
 - Tumor and abscess imaging
- Basic physical principles of nuclear medicine imaging and instrumentation

- Isotopes (including physical and chemical properties) that are used routinely in the compounding of radiopharmaceuticals for nuclear radiology procedures
- Indications for isotopes used for therapeutic purposes
- Normal and abnormal findings on all imaging and functional studies, other than nuclear cardiology studies
- Nuclear studies, including indications, pathologies, protocols, correlative studies, radiopharmaceuticals used for each study, and various parameters that might interfere with the results of the procedure
- Clinical indications, general procedures, and findings in:
 - Myocardial perfusion studies (rest and stress)
 - Myocardial infarct imaging
 - Multigated acquisition imaging and function studies
- Radiopharmaceuticals used in cardiac nuclear studies, including the methods of red cell labeling, patient dosages, and physical properties of the isotopes.
- Patient conditions and patient monitoring requirements, particularly in relation to exercise and drug stress studies
- Range of invasive and noninvasive tests, test characteristics, and the prognostic value of tests used to evaluate cardiac disease
- Radiopharmaceuticals used in Nuclear Radiology studies:
 - Production of isotopes
 - Physical properties of isotopes
 - Generation elution and quality control
 - Compounding of radiopharmaceuticals
 - Radiochemical quality control
 - Biodistribution and mechanisms of localization
- Calculation of patient doses, using information related to decay factors, volume concentration, and patient parameters
- Procedures and rationale for instrument quality control in nuclear medicine
- Rules and regulations that apply to the practice of nuclear radiology

2. Compulsory rotations in the relevant fields

Clinical training experiences are described below. The frame work for core training will consist of the rotations in:

- Nuclear medicine ----- 8weeks

- MRI ---- 8 weeks
- Paediatric Radiology ----8 weeks
- Neuro-radiology----- 8 weeks

The educational objective of rotations is to give appropriate experience in;

System - based subspecialties:

- Breast imaging
- Cardiac imaging
- Gastrointestinal imaging
- Head and neck imaging including ear, nose and throat
- Muscular skeleton and trauma imaging
- Neuro-radiology
- Obstetric imaging
- Gynaecological imaging
- Thoracic imaging
- Uro-radiology
- Vascular imaging

Technique- based subspecialties:

- C.T., MRI, US, Interventional Radiology and Radionuclide radiology

Disease- based subspecialty:

- Oncological imaging

Age - based subspecialty:

- Paediatric imaging

3. Research/ Thesis Writing



Total of one year will be allocated for work on a research project with thesis writing. Project must be completed and thesis be submitted before the end of training. Research can be done as one block in 5th year of training or it can be stretched over five years of training in the form of regular periodic rotations during the course as long as total research time is equivalent to one calendar year.

Research Experience

The active research component program must ensure meaningful, supervised research experience with appropriate protected time for each resident while maintaining the essential clinical experience. Recent productivity by the program faculty and by the residents will be required, including publications in peer-reviewed journals. Residents must learn the design and interpretation of research studies, responsible use of informed consent, and research methodology and

interpretation of data. The program must provide instruction in the critical assessment of new therapies and of the surgical literature. Residents should be advised and supervised by qualified staff members in the conduct of research.

Clinical Research

Each resident will participate in at least one clinical research study to become familiar with:

1. Research design
2. Research involving human subjects including informed consent and operations of the Institutional Review Board and ethics of human experimentation
3. Data collection and data analysis
4. Research ethics and honesty
5. Peer review process

This usually is done during the consultation and outpatient clinic rotations.

Case Studies or Literature Reviews

Each resident will write, and submit for publication in a peer-reviewed journal, a case study or literature review on a topic of his/her choice.

Laboratory Research



Bench Research

Participation in laboratory research is at the option of the resident and may be arranged through any faculty member of the Division. When appropriate, the research may be done at other institutions.

Research involving animals

Each resident participating in research involving animals is required to:

1. Become familiar with the pertinent Rules and Regulations of the Fatima Jinnah Medical University Lahore i.e. those relating to "Health and Medical Surveillance Program for Laboratory Animal Care Personnel" and "Care and Use of Vertebrate Animals as Subjects in Research and Teaching"
2. Read the "Guide for the Care and Use of Laboratory Animals"
3. View the videotape of the symposium on Humane Animal Care

Research involving Radioactivity

Each resident participating in research involving radioactive materials is required to

1. Attend a Radiation Review session
2. Work with an Authorized User and receive appropriate instruction from him/her.



METHODS OF INSTRUCTION/COURSE CONDUCTION

As a policy, active participation of students at all levels will be encouraged. Following teaching modalities will be employed:

1. Lectures
2. Seminar Presentation and Journal Club Presentations
3. Group Discussions
4. Grand Rounds
5. Clinico-pathological Conferences
6. SEQ as assignments on the content areas
7. Skill teaching in ICU, emergency and ward settings
8. Attend genetic clinics and rounds for at least one month.
9. Attend sessions of genetic counseling
10. Self study, assignments and use of internet



11. Bedside teaching rounds in ward
12. OPD & Follow up clinics
13. Long and short case presentations

In addition to the conventional teaching methodologies interactive strategies like conferences will also be introduced to improve both communication and clinical skills in the upcoming consultants. Conferences must be conducted regularly as scheduled and attended by all available faculty and residents. Residents must actively request autopsies and participate in formal review of gross and microscopic pathological material from patients who have been under their care. It is essential that residents participate in planning and in conducting conferences.

1. Clinical Case Conference

Each resident will be responsible for at least one clinical case conference each month. The cases discussed may be those seen on either the consultation or clinic service or during rotations in specialty areas. The resident, with the advice of the Attending Physician on the Consultation Service, will prepare and present the case(s) and review the relevant literature.

2. Monthly Student Meetings

Each affiliated medical college approved to conduct training for MD Radiology will provide a room for student meetings/discussions such as:

- a. Journal Club Meeting
- b. Core Curriculum Meetings
- c. Skill Development

a. Journal Club Meeting

A resident will be assigned to present, in depth, a research article or topic of his/her choice of actual or potential broad interest and/or application. Two hours per month should be allocated to discussion of any current articles or topics introduced by any participant. Faculty or outside researchers will be invited to present outlines or results of current research activities. The



article should be critically evaluated and its applicable results should be highlighted, which can be incorporated in clinical practice. Record of all such articles should be maintained in the relevant department.

b. Core Curriculum Meetings

All the core topics of Radiology should be thoroughly discussed during these sessions. The duration of each session should be at least two hours once a month. It should be chaired by the chief resident (elected by the residents of the relevant discipline). Each resident should be given an opportunity to brainstorm all topics included in the course and to generate new ideas regarding the improvement of the course structure

c. Skill Development

Two hours twice a month should be assigned for learning and practicing clinical skills.

List of skills to be learnt during these sessions is as follows:

1. Residents must develop a comprehensive understanding of the indications, contraindications, limitations, complications, techniques, and interpretation of results of those technical procedures integral to the discipline.
2. Residents must acquire knowledge of and skill in educating patients about the technique, rationale and ramifications of procedures and in obtaining procedure-specific informed consent. Faculty supervision of residents in their performance is required, and each resident's experience in such procedures must be documented by the program director.
3. Residents must have instruction in the evaluation of medical literature, clinical epidemiology, clinical study design, relative and absolute risks of disease, medical statistics and medical decision-making.
4. Training must include cultural, social, family, behavioral and economic issues, such as confidentiality of information, indications for life support systems, and allocation of limited resources.
5. Residents must be taught the social and economic impact of their decisions on patients, the primary care physician and society. This can be achieved by attending the bioethics lectures and becoming familiar with



Project Professionalism Manual such as that of the American Board of Internal Medicine.

6. Residents should have instruction and experience with patient counseling skills and community education.
7. This training should emphasize effective communication techniques for diverse populations, as well as organizational resources useful for patient and community education.
8. Residents may attend the series of lectures on Nuclear Medicine procedures (radionuclide scanning and localization tests and therapy) presented to the Radiology residents.
10. Residents should have experience in the performance of clinical laboratory and radionuclide studies and basic laboratory techniques, including quality control, quality assurance and proficiency standards.
11. Each resident will observe and participate in each of the related procedures (pg.12 & 13), preferably done on patients firstly under supervision and then independently

3. Annual Grand Meeting

Once a year all residents enrolled for MD Radiology should be invited to the annual meeting at FJMU Lahore.

One full day will be allocated to this event. All the chief residents from affiliated institutes will present their annual reports. Issues and concerns related to their relevant courses will be discussed. Feedback should be collected and suggestions should be sought in order to involve residents in decision making.

The research work done by residents and their literary work may be displayed.

In the evening an informal gathering and dinner can be arranged. This will help in creating a sense of belonging and ownership among students and the faculty.

LOG BOOK

The residents must maintain a log book and get it signed regularly by the supervisor. A complete and duly certified log book should be part of the requirement to sit for MD examination. Log book should include adequate number of diagnostic and therapeutic procedures observed and performed, the indications for the procedure, any complications and the interpretation of the results, routine and emergency management of patients, case presentations in CPCs, journal club meetings and literature review.

Proposed Format of Log Book is as follows:

Candidate's Name: -----

Supervisor -----

Roll No. -----

The procedures shall be entered in the log book as per format

Residents should become proficient in performing the related procedures (pg.12 & 13). After observing the technique, they will be observed while performing the procedure and, when deemed competent by the supervising physician, will perform it independently. They will be



responsible for obtaining informed consent, performing the procedure, reviewing the results with the pathologist and the attending physician and informing the patient and, where appropriate, the referring physician of the results.

Procedures Performed

Sr.#	Date	Name of Patient, Age, Sex & Admission No.	Diagnosis	Procedure Performed	Supervisor's Signature
1					
2					
3					
4					

Radiological Emergencies Handled

Sr.#	Date	Name of Patient, Age, Sex & Admission No.	Diagnosis	Procedure/ Management	Supervisor's Signature
1					
2					
3					
4					

Case Presented

Sr.#	Date	Name of Patient, Age, Sex & Admission No.	Case Presented	Supervisor's Signature
1				
2				
3				
4				

Seminar/Journal Club Presentation

Sr.#	Date	Topic	Supervisor's Signature
1			
2			
3			
4			

Evaluation Record

(Excellent, Good, Adequate, Inadequate, Poor)

At the end of the rotation, each faculty member will provide an evaluation of the clinical performance of the fellow.

Sr.#	Date	Method of Evaluation (Oral, Practical, Theory)	Rating	Supervisor's Signature
1				
2				



EVALUATION & ASSESSMENT STRATEGIES

Assessment

It will consist of action and professional growth oriented ***student-centered integrated assessment*** with an additional component of ***informal internal assessment, formative assessment*** and measurement-based ***summative assessment***.

Student-Centered Integrated Assessment

It views students as decision-makers in need of information about their own performance. Integrated Assessment is meant to give students responsibility for deciding what to evaluate, as well as how to evaluate it, encourages students to '**own**' the evaluation and to use it as a basis for self-improvement. Therefore, it tends to be growth-oriented, student-controlled, collaborative, dynamic, contextualized, informal, flexible and action-oriented.

In the proposed curriculum, it will be based on:

- Self Assessment by the student
- Peer Assessment
- Informal Internal Assessment by the Faculty

Self Assessment by the Student

Each student will be provided with a pre-designed self-assessment form to evaluate his/her level of comfort and competency in dealing with different relevant clinical situations. It will be the responsibility of the student to correctly identify his/her areas of weakness and to take appropriate measures to address those weaknesses.

Peer Assessment



The students will also be expected to evaluate their peers after the monthly small group meeting. These should be followed by a constructive feedback according to the prescribed guidelines and should be non-judgmental in nature. This will enable students to become good mentors in future.

Informal Internal Assessment by the Faculty

There will be no formal allocation of marks for the component of Internal Assessment so that students are willing to confront their weaknesses rather than hiding them from their instructors.

It will include:

- a. Punctuality
- b. Ward work
- c. Monthly assessment (written tests to indicate particular areas of weaknesses)
- d. Participation in interactive sessions

Formative Assessment

Will help to improve the existing instructional methods and the curriculum in use

Feedback to the faculty by the students:

After every three months students will be providing a written feedback regarding their course components and teaching methods. This will help to identify strengths and weaknesses of the relevant course, faculty members and to ascertain areas for further improvement.

Summative Assessment

It will be carried out at the end of the programme to empirically evaluate **cognitive, psychomotor** and **affective domains** in order to award degrees for successful completion of courses.

Abridged Examination
MD Radiology
Total Marks: 350

All candidates admitted in MD Radiology course shall appear in Abridged examination at the end of 1st calendar year.

Abridged Examination at the end of 1st calendar

Written Examination =300 Marks



Video projected clinical Examination = 50 Marks

Total = 350 marks

There shall be 150 MCQs write single best type of answer as for

Principles of Internal Medicine = 50 MCQs

Principles of General surgery = 50 MCQs

Physics applied to Radiology = 50 MCQs

Each MCQ will carry 2 marks and each incorrect response will result in deductions of 1.5 duration of this exam will be 150 minutes. The candidate securing 50% marks will paper the written examination and will be eligible to appear in the video projected clinical exam.

Video Projected Clinical Part of Abridged Exam (VPCE)

The VPCE will consist of 25 videos/ Slides of clinical material and scenarios from Internal Medicine, General Surgery and Radiology. Each Video/ slide will have one question and carry 2 marks. Incorrect response will result in deduction of 0.5 marks. The Candidate securing 50% marks in VPCE will pass this part of exam



Final Examination MD Radiology
Total Marks: 1500

All candidates admitted in MD course shall appear in Final examination at the end of structured training programme (end of 4th calendar year) and after clearing Abridged Examination.

There shall be two written papers of 250 marks each, Clinical, TOACS/OSCE & ORAL of 500 marks, continues Internal Assessment of 100 marks and thesis examination of 400 marks.

Topics included in paper 1

- | | |
|---|-----------|
| 1. General Radiology | (20 MCQs) |
| 2. Breast Imaging | (15 MCQs) |
| 3. Chest & Cardiovascular Radiology | (20 MCQs) |
| 4. Vascular and interventional Radiology | (15 MCQs) |
| 5. Nuclear radiology & Radiation Protection | (15 MCQs) |
| 6. Emergency radiology | (15 MCQs) |

Topics included in paper 2

- | | |
|-------------------------------|-----------|
| 1. Musculoskeletal Radiology | (15 MCQs) |
| 2. Genitourinary Radiology | (20 MCQs) |
| 3. Gastrointestinal Radiology | (15 MCQs) |
| 4. Neuroradiology | (15 MCQs) |
| 5. Head and neck Radiology | (15 MCQs) |
| 6. Paediatric Radiology | (20 MCQs) |

Components of Final Examination

Theory

Paper I

5 SEQs

250 Marks

50 Marks

3 Hours



100 MCQs

200Marks

Paper II

5 SEQs

100 MCQs

250 Marks

50 Marks

200 Marks

3 Hours

The candidates, who pass in theory papers, will be eligible to appear in the Clinical, TOACS/OSCE & ORAL.

Clinical. TOACS/OSCE & ORAL

Four short cases

200 Marks

One long case:

100 Marks

Clinical, TOACS/OSCE & ORAL

200 Marks

Continuous Internal Assessment

100 Marks

Thesis Examination

400 Marks

All candidates admitted in MD courses shall appear in thesis examination at the end of 4th calendar year of the MD programme. The examination shall include thesis evaluation with defense.

RECOMMENDED BOOKS

1. Ryan S. **Anatomy for Diagnostic Imaging**. 2nd ed. Saunders;2004 .
2. Bushong S. C. **Radiological Science for Technologists Physics, Biology and Protection**. 8th ed. Mosby;2004.
3. Chapman S. and Nakienly R. **A Guide to Radiological Procedures**. 4th ed. Baillier Tindall, Jaypee Brothers; 2001.
4. Bhargava S. K. **Radiological Procedures**. 1st ed. Delhi: Peepee Publishers; 2004.
5. Chapman S. and Nakielny R. **Aids to Radiological Differential Diagnosis**. 4th ed. Elsevier Science Limited; 2003.
6. Holm T. **WHO Basic Radiologic System: Manual of Radiographic Techniques**. Delhi: AITBS Publishers; 2002.
7. Sutton D. **Textbook of Radiology and imaging (Vol. I and II)**.7th ed. UK: Churchill Livingstone; 2003.
8. Clark. **Clark's Textbook of Positioning in Radiology**. 12th ed. Hoddler Arnold Publications; 2005.



APPENDIX "E"
(See Regulation 9-iii)

MANDATORY WORKSHOPS

1. Each candidate of MD/MS/MDS program would attend the 04 mandatory workshops and any other workshop as required by the university.
2. The four mandatory workshops will include the following
 - a. Research Methodology
 - b. Statistics
 - c. Communication Skills
 - d. Introduction to Computer / Information Technology and Software programs
3. The workshops will be held on 03 monthly basis.
4. An appropriate fee for each workshop will be charged.
5. Each workshop will be of 02 - 05 days duration.
6. Certificates of attendance will be issued upon satisfactory completion of workshops.



APPENDIX "F"
(See Regulation 9xxiii, 13, 14 & 16)

CONTINUOUS INTERNAL ASSESSMENTS

a) Workplace Based Assessments

Workplace based assessments will consist of Generic as well as Specialty Specific Competency Assessments and Multisource Feedback Evaluation.

Generic Competency Training & Assessments

The Candidates of all MD / MS / MOS programs will be trained and assessed in the following five generic competencies.

i. Patient Care.

- a. Patient care competency will include skills of history taking, examination, diagnosis, plan of investigation, clinical judgment, plan of treatment, consent, counseling, plan of follow up, communication with patient/relatives and staff.
- b. The candidate shall learn patient care through ward teaching, departmental conferences, morbidity and mortality meetings, Core curriculum lectures and training in procedures and operations.
- c. The candidate will be assessed by the supervisor during presentation of cases on clinical ward rounds, scenario based discussions on patient management, multisource feedback evaluation, Direct Observation of Procedures (OOPS) and operating room assessments.
- d. These methods of assessments will have equal weightage.

ii. Medical Knowledge and Research

- a. The candidate will learn basic factual knowledge of illnesses relevant to the specialty through lectures/discussions on topics selected from the syllabus, small group tutorials and bed side rounds.
- b. The medical knowledge/skill will be assessed by the teacher during ^{pr} _{pr}
- c. The candidate will be trained in designing research project, data collection, data analysis and presentation of results by the supervisor.

- d. The acquisition of research skill will be assessed as per regulations governing thesis evaluation and its acceptance.

iii. Practice and System Based Learning

- a. This competency will be learnt from journal clubs, review of literature policies and guidelines, audit projects, medical error investigation, root cause analysis and awareness of healthcare facilities.
- b. The assessment methods will include case studies, presentation in morbidity and mortality review meetings and presentation of audit projects if any.
- c. These methods of assessment shall have equal weightage.

iv. Communication Skills

- a. These will be learnt from role models, supervisor and workshops.
- b. They will be assessed by direct observation of the candidate whilst interacting with the patients, relatives, colleagues and through multisource feedback evaluation.

v. Professionalism as per Hippocratic Oath

- a. This competency is learnt from supervisor acting as a role model, ethical case conferences and lectures on ethical issues such as confidentiality, informed consent, end of life decisions, conflict of interest, harassment and use of human subjects in research.
- b. The assessment of residents will be through multisource feedback evaluation according to proformas of evaluation and its scoring method.

Specialty Specific Competencies

- i. The candidates will be trained in operative and procedural skills according to a quarterly based schedule
- ii. The level of procedural competency will be according to a competency table to be developed by each specialty



iii. The following key will be used for assessing operative and procedural competencies:

a. Level 1 Observer status

The candidate physically present and observing the supervisor and senior colleagues

b. Level 2 Assistant status

The candidate assisting procedures and operations

c. Level 3 Performed under supervision

The candidate operating or performing a procedure under direct supervision

d. Level 4 Performed independently

The candidate operating or performing a procedure without any supervision

iv. Procedure Based Assessments (PBA)

- a. Procedural competency will assess the skill of consent taking, preoperative preparation and planning, intraoperative general and specific tasks and postoperative management
- b. Procedure Based assessments will be carried out during teaching and training of each procedure.
- c. The assessors may be supervisors, consultant colleagues and senior residents.
- d. The standardized forms will be filled in by the assessor after direct observation.
- e. The resident's evaluation will be graded as satisfactory, deficient requiring further training and not assess at all.
- f. Assessment report will be submitted
- g. A satisfactory score will be required to be eligible for taking final examination.

Multisource Feedback Evaluation

- i. The supervisor would ensure a multisource feedback to **called** peer assessments in medical knowledge, clinical skills, communication skills, professionalism, integrity, and responsibility.
- ii. Satisfactory annual reports will be required to become eligible for the final examination

b) Completion Of Candidate's Training Portfolio

- i. The Candidate's Training *Portfolio* (CTP) will be published (or computer based portfolio downloadable) by the university.
- ii. The candidates would either purchase the CTP or download it from the KMU web site.
- iii. The portfolio will consist of the following components
 - a) Enrollment details.
 - b) Candidate's credentials as submitted on the application for admission form.
 - c) Timeline of scheduled activities eg dates of commencement of training, completion of training, submission of synopsis and tesis, assessments and examination dates etc (Appendix H)
 - d) Log Book of case presentations. Operation and procedures recorded in an appropriate format and validated by the supervisor.
 - e) Record of participation and presentations in academic activities eg lectures, workshops, journal clubs, clinical audit projects, morbidity & mortality *review* meetings, presentation in house as well as national and international meetings.
 - f) Record of Publications if any.
 - g) Record of results of assessment and examinations if any.
 - h) Synopsis submission proforma and IRB proforma and A&RB approval letter
 - i) Copy of Synopsis as approved by AS&RB
- iv. Candidate's Training Portfolio shall be assessed as per proforma given "Appendix-G".



Supervisor's Annual Review Report.

This report will consist of the following components:

- i. Verification and validation of Log Book of operations & procedures according to the expected number of operations and procedures performed (as per levels of competence) determined by relevant standards of studies.
- ii. A 90 % attendance in academic activities is expected. The academic activities will include: Lectures, Workshops other than mandatory workshop, Journal clubs, Morbidity & Mortality Review Meeting and Other presentations.
- iii. Assessment report of presentations and lectures
- iv. Compliance Report to meet timeline for completion of research project.
- v. Compliance Report on Personal Development Plan.
- vi. Multisource Feedback Report, on relationship with colleagues, patients.
- vii. Supervisor will produce an annual report based on assessments performed proforma in appendix-G and submit it to the EXCEL (EXCEL - I) DeP, SrOJ/It.
- viii. 75 % score will be required to pass the Continuous Internal Assessment on annual review.



APPENDIX " G "

(See Regulation 9ix, 9xxili-d, 10, 11, 14 & 16)

Supervisor's Evaluation

PROFORMA FOR CONTINUOUS INTERNAL ASSESSMENTS

1. Generic Competencies		
(Please score from 1 – 100. 75% shall be the pass marks)		Component Score
i. Patient Care		20
ii. Medical Knowledge and Research		20
iii. Practice and System Based Learning		
• Journal Clubs		04
• Audit Projects		04
• Medical Error Investigation and Root Cause Analysis		04
• Morbidity / Mortality / Review meetings		04
• Awareness of Health Care Facilities		04
iv. Communication Skills		
• Informed Consent		10
• End of life decisions		10
v. Professionalism		
• Punctuality and time keeping		04
• Patient doctor relationship		04
• Relationship with colleagues		04
• Awareness of ethical issues		04
• Honesty and integrity		04
2. Specialty specific competencies		
Please score from 1 – 100. 75% shall be the pass marks		Score achieved
Operative Skills / Procedural Skills		
3. Multisource Feedback Evaluation (Please score from 1 – 100. 75% shall be the pass marks)		
4. Candidates Training Portfolio (Please score from 1 – 100. 75% shall be the pass marks)		
(Please score from 1 – 100. 75% shall be the pass marks)		Component Score
i. Log book of operations and procedures		25
ii. Record of participation and presentation in academic activities		25
iii. Record of publications		25
iv. Record of results of assessments and examinations		25